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ABSTRACT

The Minnesota Child Development Inventory (MCDI) measures the development of preschool-age children, using an inventory format to obtain mothers' observations. To demonstrate the validity of MCDI results, the authors compared them to the results of psychological evaluations, including data on intellectual functioning, fine motor skills, and expressive language development. The study sample consisted of 109 children referred to a university clinic for psychological evaluation. Four MCDI scales (General Development, Fine Motor, Expressive Language, and Comprehension-Conceptual) and the MCDI profile as a whole corresponded well with the conclusions of psychological evaluation. (Author/RC)

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Minnesota Child Development Inventory

Identification of Children with Developmental Disorders

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Child health and development specialists are becoming increasingly interested in the early identification of children with developmental disorders. The Minnesota Child Development Inventory (MCDI) was created to measure the development of preschool-age children. The MCDI booklet contains 320 empirically derived items describing behaviors of children aged 2 months to 6 years. The mother responds "yes" or "no" to each item to indicate whether she has observed the behavior in her child. MCDI results are represented on a profile of eight scales: General Development, Gross Motor, Fine Motor, Expressive Language, Comprehension-Conceptual, Situation Comprehension, Self Help, and Personal-Social. Developmental norms have been established for a sample of 796 white children aged 6 months to 6 1/2 years. Each child may thus be classified as normal, borderline, or retarded on each scale and on

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the profile as a whole. The MCDI is intended for the preliminary identification of the child whose development is below expectations for his age and sex.

Purpose

The present study evaluated the validity of the MCDI for identifying children with developmental disorders by comparing MCDI results with the results of direct psychological testing.

Method

The subjects for this study were 109 white preschool-age children who had been referred to the University of Minnesota Health Sciences Center Child Psychology Clinic for psychological evaluation regarding a variety of developmental problems and parental concerns. The children were between 16 and 72 months in age, with the majority 36 months of age or older. There were two girls for every five boys in the sample. Intelligence testing showed that about 40 percent of the sample had IQs clearly in the average range or better, while 25 percent of the sample were retarded. The educational levels of the mothers ranged from 11 to 20 years; 99 percent of these mothers were high school graduates and 17 percent college graduates.

Each mother was asked to complete an MCDI while her

child was being tested at the Clinic. Psychological test reports on the children included intelligence quotients (usually the Stanford-Binet or Wechsler Preschool and Primary Scale of Intelligence), evaluations of fine motor coordination and expressive language development, as well as observations of behavior in the testing situation (alertness and responsiveness to the examiner, and general activity level and distractibility). Visual and auditory impairments were noted; the results of speech and language and hearing evaluations were also used in a few cases.

MCDI results for each scale were classified as normal, borderline, or retarded according to a rationale similar to that traditionally used in classifying intelligence quotients: On a given scale, the child's score is judged to be within normal limits if it falls at or above the mean score achieved by children 20 percent younger than himself. The score is judged borderline if it falls at or above the mean score achieved by children 30 percent younger than himself and below the mean score achieved by children 20 percent younger than himself. The score is judged retarded if it falls below the mean score achieved by children 30 percent younger than himself. The profile as a whole was classified as normal if all scores were within normal limits, as borderline if any scores were borderline and none were

retarded, and as retarded if any scores were retarded. Psychological test results were classified in a fashion similar to that used for the individual MCDI scales.

A number of comparisons were made: (1) The General Development Scale was compared to IQ, to the rating of fine motor skills, and to the rating of expressive language development. (2) The Fine Motor Scale was compared to the fine motor rating. (3) The Expressive Language Scale was compared to the expressive language rating. (4) The Comprehension-Conceptual Scale was compared to IQ. (5) The MCDI profile as a whole was compared to IQ, to the fine motor rating, and to the expressive language rating. All these comparisons will be explained further below. Adequate criteria were not available to evaluate the Gross Motor, Situation Comprehension, Self Help, and Personal-Social Scales.

Results

General Development Scale (GD): The GD Scale is composed of the most discriminating items from the other seven scales; it is by far the longest of the scales. It is intended to provide a general index of developmental deviation. In accordance with its purpose, GD scale results were compared to a combined rating of IQ, fine motor skills, and expressive

language development. If all three areas were within normal limits, the criterion (that is, the results of the psychological evaluation) was classified as normal. If one or more areas were in the borderline range but none in the retarded range, the criterion was classified as borderline. If one or more areas were within the retarded range, the criterion was classified as retarded. These three classifications of the criterion are plotted against the corresponding three classifications of the General Development Scale in Figure 1.

Figure 1 shows that 85 percent of the children classified as retarded on the General Development Scale are also classified as retarded on the basis of psychological evaluation; no children so classified on the GD Scale are classified as normal on the criterion. Of those classified as borderline on the GD scale, 60 percent are classified as borderline on the criterion and 30 percent as retarded. Thus, a deviant GD score (either borderline or retarded) is associated with an increased incidence of deviation on the criterion, significantly above the base rate (97 percent vs. 87 percent; $p < .01$).* A normal GD score cannot be used to predict normal performance in psychological testing; however, the scale is intended as an index of deviation rather than

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* All probability values are based on χ^2.

of normality.

Fine Motor Scale (FM): The FM Scale results were compared to ratings of fine motor performance in psychological testing. Figure 2 shows the criterion fine motor rating plotted against the corresponding classifications of the Fine Motor Scale.

Figure 2 shows that, of the children classified as retarded on the Fine Motor Scale, 64 percent are classified as retarded (vs. base rate of 26 percent) and only 10 percent as normal on the basis of psychological evaluation ($p < .001$). Of those children classified as normal on the FM Scale, 72 percent are classified as normal on the basis of psychological evaluation (vs. base rate of 46 percent) and only 4 percent as retarded ($p < .001$). Eighty-two percent of children classified as deviant (retarded or borderline) on the FM Scale are also deviant on psychological testing (vs. base rate of 54 percent; $p < .001$). Thus, although there is considerable overlap among categories, there is a highly significant association between the FM Scale and the criterion in both the deviant and the normal directions.

Expressive Language Scale (EL): The EL Scale results were compared to ratings of expressive language development based on the psychological evaluations. Classifications

of the criterion are plotted against the corresponding three classifications of the Expressive Language Scale in Figure 3.

Figure 3 shows that, of the children classified as retarded on the Expressive Language Scale, 71 percent are classified as retarded (vs. base rate of 59 percent) and only 3 percent as normal on the basis of psychological evaluation ($p < .05$). Because the EL Scale is effective only for children whose expressive language development is below the 36-month level, the numbers of cases in the borderline and normal ranges are too small for analysis.

Comprehension-Conceptual Scale (CC): The CC Scale measures verbal comprehension; it was therefore compared to those intelligence test results which describe primarily verbal comprehension (the Stanford-Binet IQ and WPPSI Verbal Scale IQ). IQs of 80 and above were classified as normal, those between 70 and 79 (inclusive) were classified as borderline, and those below 70 were classified as retarded, according to traditional practice. These three classifications of the criterion are plotted against the corresponding three classifications of the Comprehension-Conceptual Scale in Figure 4.

Figure 4 shows that, of those children classified as retarded on the Comprehension-Conceptual Scale, 30 percent

are classified as retarded and 35 percent as normal on the criterion. Though the correspondence between retardation on the CC Scale and on the criterion is statistically significant ($p < .05$), the scale cannot be used to predict intellectual retardation. In fact, more than one-third of the children who scored in the retarded range on the CC Scale had normal IQs. In six cases (23 percent), this discrepancy was associated with an expressive language problem. On the other hand, 88 percent of those children who scored in the normal range on the CC Scale also had normal range IQs; a normal score on the CC Scale thus tends to contraindicate intellectual retardation ($p < .01$).

MCDI Profile: The psychological test results and the MCDI profile as a whole were classified as described above (see Method). The category "retarded," as it is used for this set of comparisons, includes both generalized mental retardation and specific major disability. The three classifications of the criterion are plotted against the corresponding three classifications of the MCDI profile in Figure 5.

Figure 5 shows that, of those children classified as retarded on the basis of the MCDI profile (that is, having one or more scales in the retarded range), 57 percent were classified as retarded (vs. base rate of 46 percent) and

only 2 percent as normal on the criterion; however, this relationship fails to achieve statistical significance ($p < .10$). However, ninety-nine percent of the children who show some form of retardation on the MCDI profile are retarded or borderline on the criterion. Numbers of cases in the normal and borderline ranges on the MCDI are too small for separate analysis.

The overall hit rate of the MCDI for deviant (borderline or retarded) vs. normal is as follows: true positives, 85 cases; true negatives, 10 cases; false positives, 4 cases; false negatives, 5 cases. Although the overall hit rate of 91 percent is somewhat greater than the base rate of 86 percent, the difference is not statistically significant ($p < .10$). The nine "misses" involved one or more of the following factors: borderline MCDI profile (3 cases); borderline psychological test results (4 cases); deviant hyperactivity rating (5 cases); expressive language problems undetected by the MCDI due to the limited age range of the EL scale (3 cases).

Discussion

Deviation from normality on the General Development, Fine Motor, Expressive Language, and Comprehension-Conceptual Scales, and on the MCDI profile as a whole are all associated

with higher rates of deviation on psychological evaluation than is shown in the base rates for this clinical population. Retarded MCDI scores are associated with high rates of criterion deviation: 100 percent for the GD Scale; 91 percent for the FM Scale; 97 percent for the EL Scale; and 99 percent for the MCDI profile as a whole. Deviation on the Comprehension-Conceptual Scale is significantly associated with intellectual retardation, but may as well reflect expressive language problems; a CC Scale score in the normal range tends to contraindicate intellectual retardation. In most cases where MCDI results and criterion results do not agree, one measure or the other is classified in the borderline range.

The results of this study suggest that the MCDI is useful for the preliminary identification of the child whose development is below expectations for his age and sex. This study and the MCDI normative study were both based on populations of white children whose mothers were generally educated at least through high school. The norms, hit rates, and error rates applicable to other populations remain to be determined. Until further research has been done, application of these results to populations significantly different from the normative sample must be made with caution.

Figure 1.

Incidence of Psychological Test Deviation as a Function of General Development Scale Deviation

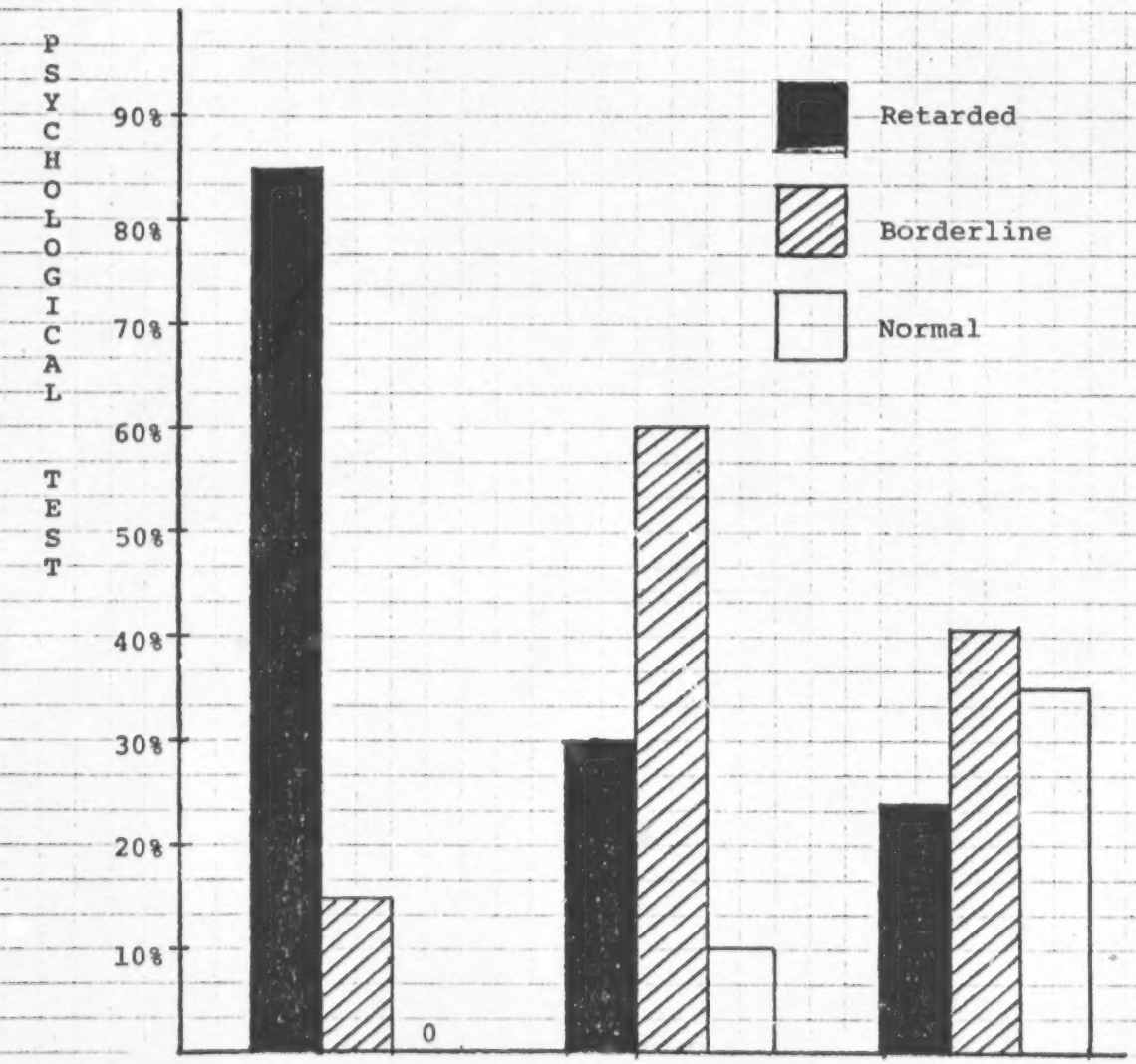

Figure 2.

Incidence of Fine Motor Test Deviation as a Function of Fine Motor Scale Deviation

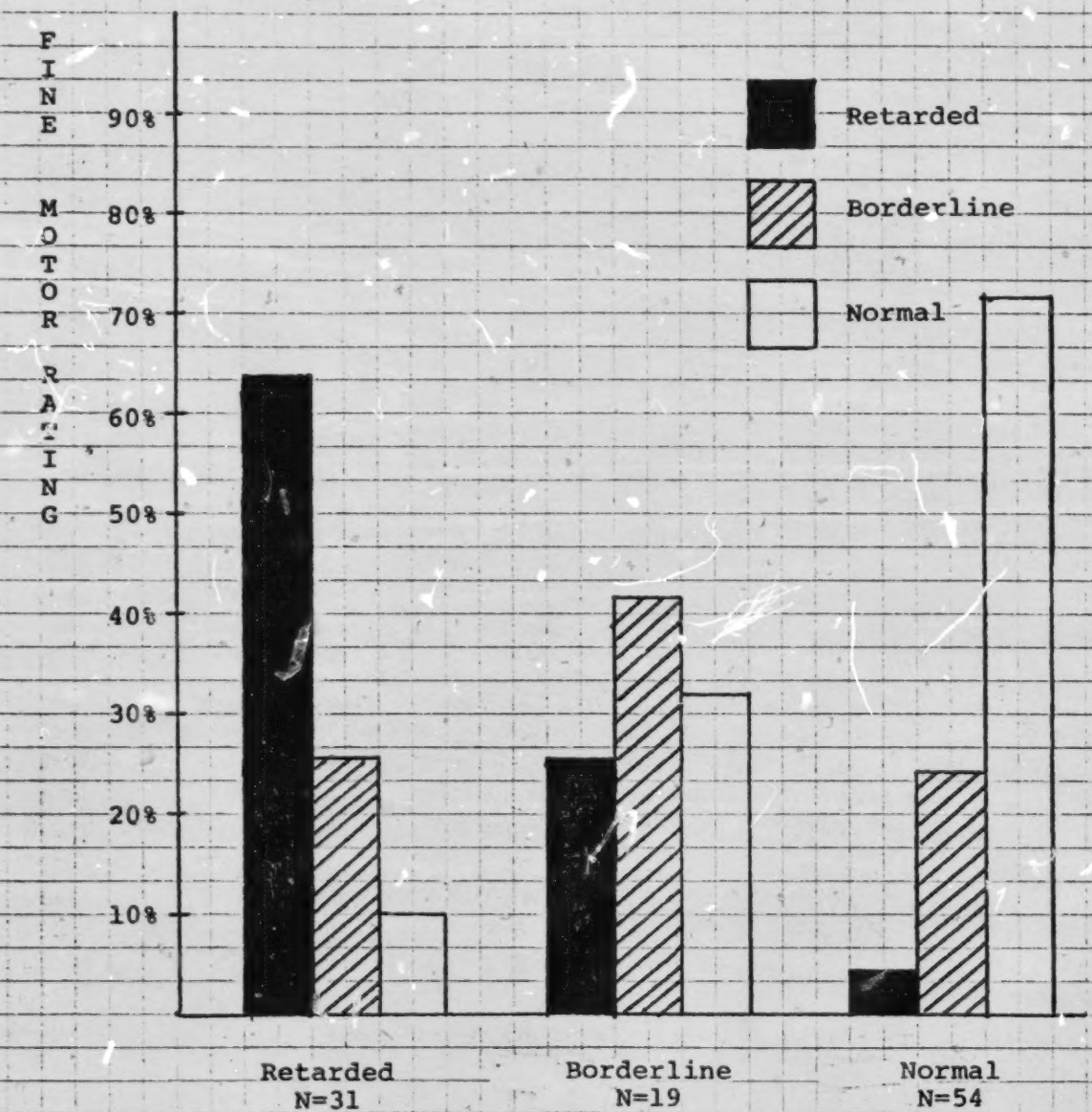

Figure 3.

Incidence of Expressive Language Deviation as a Function of Expressive Language Scale Deviation

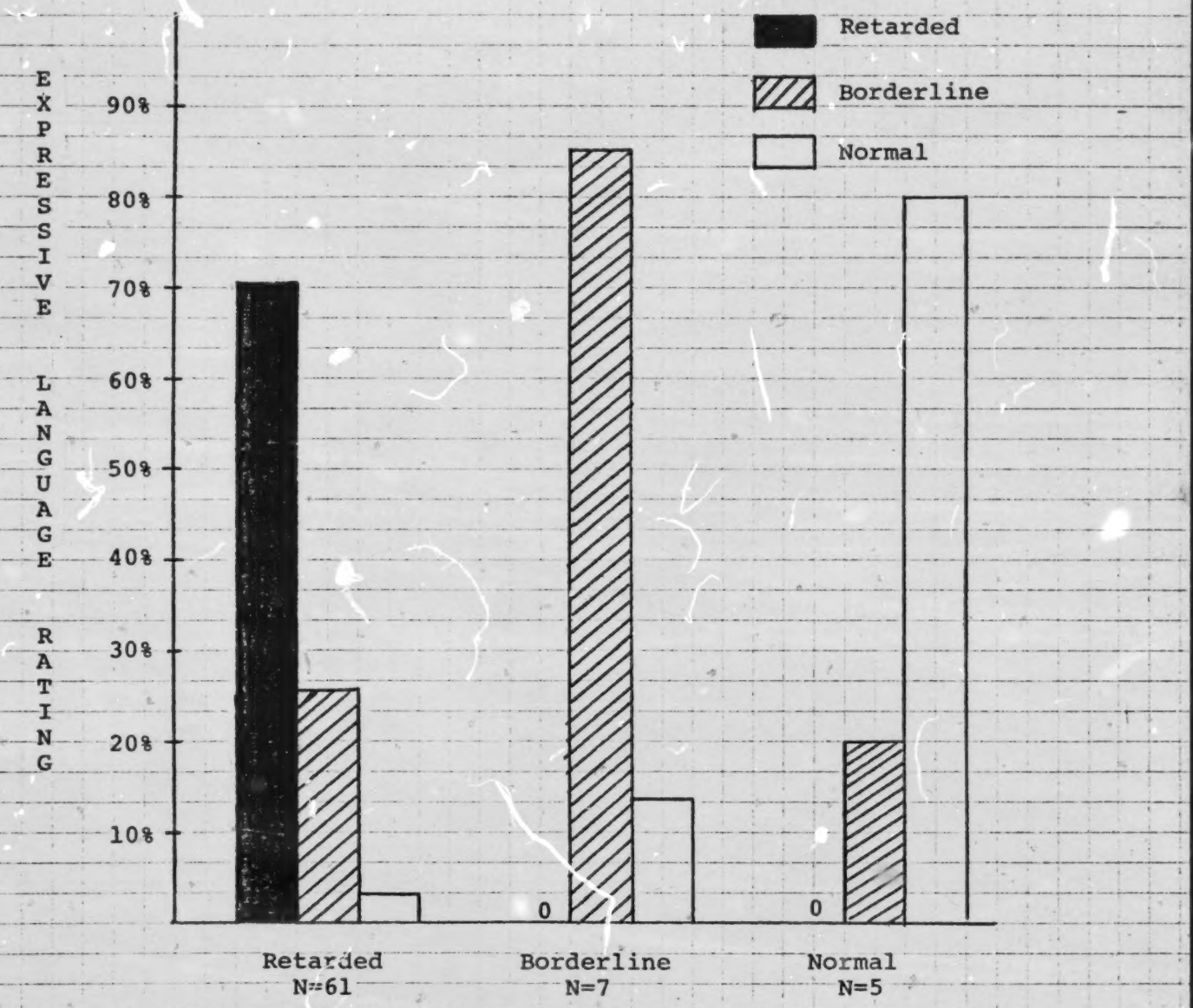

Figure 4.

Incidence of IQ Deviation as a Function of Comprehension-Conceptual Scale Deviation

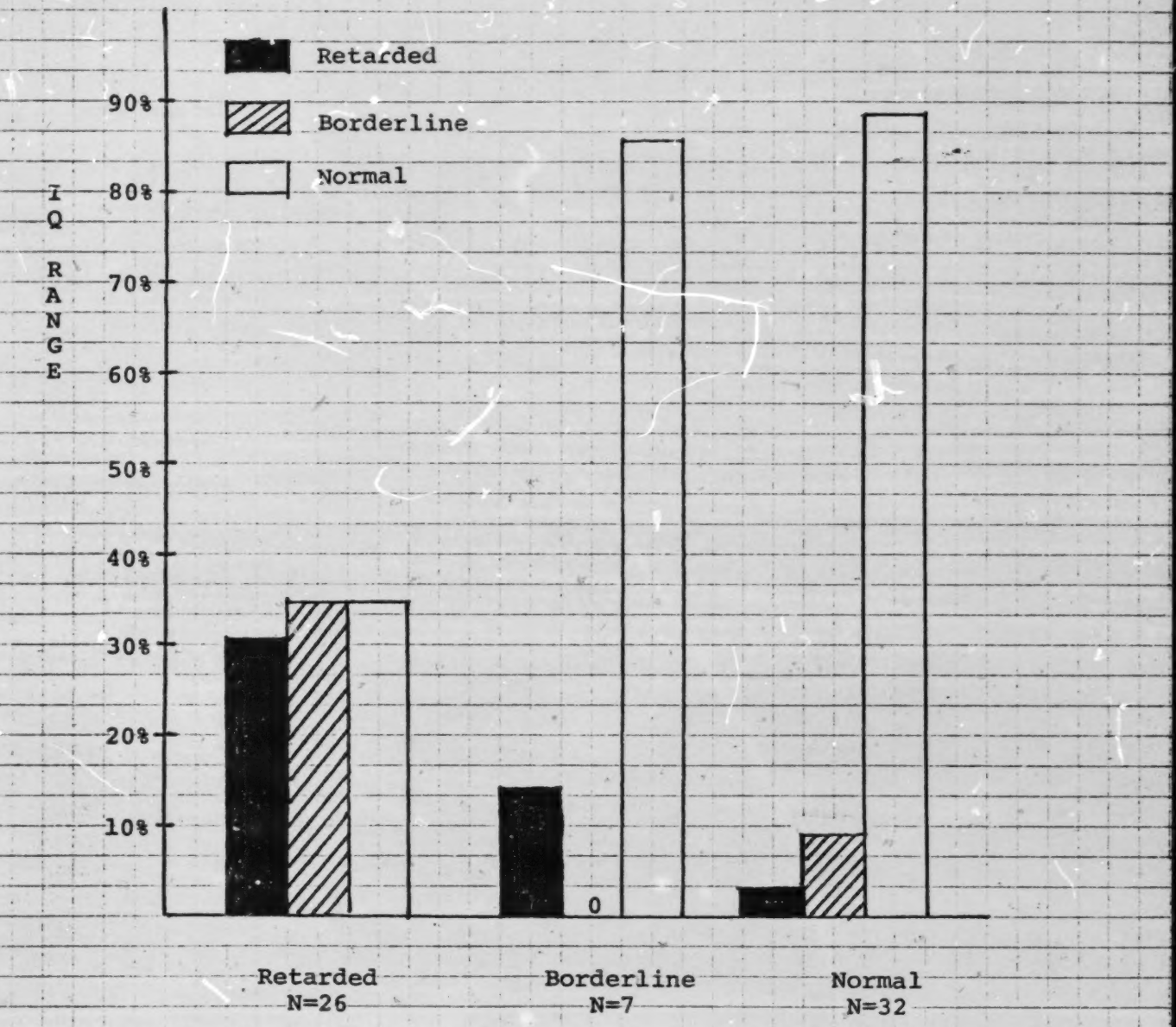

Figure 5.

Incidence of P ychological Test Deviation as a Function of MCDI Profile Deviation